

ACCESSION #: 9607080283

LICENSEE EVENT REPORT (LER)

FACILITY NAME: River Bend Station PAGE: 1 OF 4

DOCKET NUMBER: 05000458

TITLE: MANUAL REACTOR SCRAM CAUSED BY FAULTY ELECTRO-HYDRAULIC

CONTROL POWER SUPPLIES

EVENT DATE: 06/06/96 LER #: 96-012-00 REPORT DATE: 07/03/96

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: D. N. Lorring, Supervisor- TELEPHONE: (504) 381-4157

Licensing

COMPONENT FAILURE DESCRIPTION:

CAUSE: A SYSTEM: CCA COMPONENT: IPWSUP MANUFACTURER: E379

REPORTABLE NPRDS: YES

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On June 6, 1996, while the plant was in mode 1 at 100% power, turbine combined intercept valves and one turbine stop valve began to close unexpectedly causing a pressure rise which caused all four moisture separator reheater relief valves to lift. This caused a reduction in turbine load, followed by a reactor feed pump trip on low suction pressure. The control valves partially closed to control throttle pressure. When the moisture separator reheater relief valves reseated, reactor pressure vessel pressure began

to increase and the average-power-range-monitor upscale alarm lights illuminated. A manual scram was then initiated.

The root cause was determined to be recently replaced electro-hydraulic control power supplies which were inadequate for their intended purpose. Even though the power supplies are configured such that a single failure should not affect the bus, a failed power supply caused bus voltage to degrade. Contributing factors included the power supplies not meeting their published design specifications and inadequate installation testing. Corrective actions included replacing the power supplies with ones that were acceptable. Various aspects of this event will be evaluated. Lessons learned training will be provided and an operating experience bulletin has been generated to alert the industry to the problems detected with the replacement power supplies.

The plant was safely and successfully shut down with all systems operating per design, resulting in no challenges to the primary fission product boundaries and no impact on nuclear safety.

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## BACKGROUND

Electro-hydraulic control [EHC] system power supplies were replaced during the recent River Bend Station (RBS) refueling outage (RF-6) which ended in February with a new design due to the power supplies approaching their useful end-of-life. The new +/- 22 volt power supplies were supplied by General Electric (GE) as an original equipment manufacturer [OEM] part but had been manufactured by a different manufacturer - Encore (\*E379\*). Pre-RF-6 power supplies were manufactured by Lambda.

## REPORTED CONDITION

On June 6, 1996, with the plant in mode 1 at 100% power, at approximately 6:10 PM, pressure upstream of the turbine combined intercept valves began to rise as a result of their unanticipated closure. As the pressure rose, all four moisture separator reheater relief valves lifted. One

turbine stop valve moved in the closed direction to less than 95 % open. Control room operators observed the bypass valves opening and noted a reduction in turbine load. At approximately 6:11 PM, a reactor feed pump tripped on low suction pressure. As a result of the intercept valve and turbine stop valve closures, reactor pressure vessel (RPV) pressure increased and peaked approximately 20 seconds later. The plant transient caused all eight average-power-range-monitor (APRM) upscale alarm lights to illuminate. A manual scram was initiated about one second after the RPV pressure peak and less than one second prior to an automatic scram initiation signal. This report is submitted pursuant to 10CFR50.73(a)(2)(iv).

#### INVESTIGATION

Following the scram, a significant event response team (SERT) was formed to investigate the event, identify the root cause(s) and recommend corrective actions. The SERT determined that the EHC house power supplied direct current (DC) power supply and the permanent magnet generator (PMG) supplied power supplies had "low volts" indications. Low volt indication for the PMG power supplies is normally expected after a turbine trip, but not normally expected for the house power supplied power supplies. Since operators check the EHC panel twice each day (at noon and midnight) and no abnormality was noted at noon, it can be deduced that the low voltage conditions occurred sometime after noon. Post-event testing of the PMG supplied +22 volt DC power supply found

that output voltage was + 18.3 volts when installed in its normal configuration. Further testing of these power supplies was performed on site. The PMG power supply operated as expected. The house power supplied power supply only provided about 8.7 volts DC after about one hour of simulated load testing.

Controller cards establish a reference voltage and process an analog voltage signal to provide positioning signals for the intercept valves, the turbine stop valve and the control valves. Minor changes in the reference voltage levels can have an adverse effect on these signals.

Post-event testing demonstrated that a voltage drop of three-tenths of a volt was sufficient to close these valves. Post-event testing to verify the EHC DC

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power supply auctioneering functions also found that the Lambda models provided a crisp transfer of load and the Encore models did not.

Immediate corrective actions included replacing the power supplies with acceptable replacement power supplies, manufactured by the pre-RF-6 manufacturer. The switchover characteristics of the power supplies were verified to operate correctly and without impacting the positioning signals of the steam valves.

A review for past similar events at River Bend Station identified no related failures. However, a search of operating experience information identified another occurrence of a similar power supply problem event at

another nuclear plant (Millstone, Unit 3) in May of 1993.

#### ROOT CAUSE

The new power supplies, supplied as an OEM replacement, but made by a different manufacturer, were inadequate for supplying the analog circuits used in the EHC system. The new power supplies not meeting their published design specifications for voltage regulation, voltage ripple, and switching to the auctioneered backup power supply was identified as a contributing factor. Another contributing factor was that the "switchover" from one power supply to another due to a failure was not included in the GE field lineup instruction. Therefore, this function was not verified to operate properly after the power supplies were replaced during RF-6.

#### CORRECTIVE ACTIONS TO PREVENT RECURRENCE

RBS will verify that the installation of the Encore power supplies was in accordance with RBS procedures and review to assure adequate configuration control practices were utilized. We will modify procedures for setting EHC power supplies to specify the location to verify voltage output. We will also include selected portions of this event in lessons-learned training for applicable maintenance personnel.

RBS intends to evaluate the following:

- o using house powered EHC power supplies and connecting to an uninterruptible power source;
- o the adequacy of supplying the Encore EHC power supplies from the

permanent magnet generator and verify that the power supplies can withstand the permanent magnet generator voltage fluctuations;

- o the testing performed for the installation of equivalent parts for adequacy and the establishment of appropriate acceptance criteria and reviews;
- o the need for a corporate supplier quality assurance concern;
- o the replacement of critical power supplies in the plant which provide power to analog control circuits (and may be susceptible to minor voltage fluctuations).

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An operating experience bulletin has been generated to alert the industry to the problems detected with the power supplies manufactured by Encore.

#### SAFETY ASSESSMENT

The plant was safely and successfully shut down following the transient, with no engineered safety feature actuation. All shutdown systems operated as per design. Operator response was timely and proper. AU plant systems responded properly as per design. None of the three primary fission product boundaries were challenged and there is no impact on nuclear safety.

Note: Energy Industry Identification Codes are indicated in the text as (\*XX\*).

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Entergy Operations, Inc.

River Bend Station

Entergy 5485 U. S. Highway 61

P.O. Box 220

St. Francisville, LA 70775

Tel 504 336 6225

Fax 504 635 5068

Rick J. King

Director

Nuclear Safety & Regulatory

Affairs

July 3, 1996

U.S. Nuclear Regulatory Commission

Document Control Desk

Mail Stop

P1-37

Washington, D.C. 20555

Subject: River Bend Station - Unit 1

Docket No. 50-458

License No. NPF-47

Licensee Event Report 50-458/96-012-00

File Nos. G9.5, G9.25.1.3

RBG-43032

RBF1-96-0260

Gentlemen:

In accordance with 10CFR50.73, enclosed is the subject report.

Sincerely,

WJF/kvm

enclosure

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July 3, 1996

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cc: U. S. Nuclear Regulatory Commission

611 Ryan Plaza Drive, Suite 400

Arlington, TX 76011

NRC Sr. Resident Inspector

P. O. Box 1050

St. Francisville, LA 70775

INPO Records Center

700 Galleria Parkway

Atlanta, GA 30339-3064

Mr. C. R. Oberg

Public Utility Commission of Texas

7800 Shoal Creek Blvd., Suite 400 North



Austin, TX 78757

Louisiana Department of Environmental Quality

Radiation Protection Division

P.O. Box 82135

Baton Rouge, LA 70884-2135

ATTN: Administrator

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